

S8	9	((electric\$2 or magnetic) adj2 field) same maxwell\$3 adj3 equation) and (((716/1).CCLS.) ((703/2).CCLS.) ((703/13,14).CCLS.))	USPAT	OR	ON	2003/04/07 13:21
S9	13	((703/13,14).CCLS.) and (maxwell\$3 adj3 equation)	USPAT	OR	ON	2003/04/07 13:27
S10	7	(((703/13,14).CCLS.) and (maxwell\$3 adj3 equation)) not (((electric\$2 or magnetic) adj2 field) same maxwell\$3 adj3 equation) and (((716/1).CCLS.) ((703/2).CCLS.) ((703/13,14).CCLS.)))	USPAT	OR	ON	2003/04/07 13:33
S11	17	meuris-p\$4.in. or schoemaker-w\$2.in. or magnus-w\$2.in.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2005/07/18 12:26
S12	3	("6064810") or ("6137492") or ("6266062").PN.	USPAT; USOCR	OR	OFF	2003/04/08 07:48
S29	2	("6665849") or ("6453275").PN.	USPAT	OR	OFF	2005/03/26 11:50
S30	22	meuris-p\$4.in. or schoemaker-w\$2.in. or magnus-w\$2.in.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/18 12:30
S31	1162	(716/1).CCLS.	US-PGPUB; USPAT	OR	OFF	2005/07/18 12:28
S32	1422	(703/2).CCLS.	US-PGPUB; USPAT	OR	OFF	2005/07/18 12:28
S33	1432	(703/13,14).CCLS.	US-PGPUB; USPAT	OR	OFF	2005/07/18 12:28
S34	2	("6665849") or ("6453275").PN.	USPAT	OR	OFF	2005/07/18 12:57
S35	6843	((maxwell\$3 or field) near3 equation\$2)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/18 12:58
S36	5071	((maxwell\$3 or field) near3 equation\$2) and (sing\$6 or one?form)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/18 12:59
S37	664	((maxwell\$3 or field) near3 equation\$2) and (sing\$6 or one?form) and (dummy or scalar)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/18 13:00

S38	48	((maxwell\$3 or field) near3 equation\$2) and (sing\$6 or one?form) and (dummy or scalar) and ("703"/\$.ccls. or "716"/\$.ccls.)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/19 06:42
S39	48	((maxwell\$3 or field) near3 equation\$2) and (sing\$6 or one?form) and (dummy or scalar) and ("703"/\$.ccls. or "716"/\$.ccls.)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/19 07:21
S40	16	"5625578".uref.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/19 09:18

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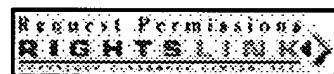
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Teaching electromagnetic field theory using differential forms**Warnick, K.F. Selfridge, R.H. Arnold, D.V.**

Dept. of Electr. & Comput. Eng., Brigham Young Univ., Provo, UT, USA;

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Abstract

The calculus of differential forms has significant advantages over traditional methods as a means for teaching electromagnetic (EM) field theory. First, films clarify the relationship between field intensities and flux densities by providing distinct mathematical and graphical representations for the two types of fields. Second, the Faraday's law of induction and the magnetic field intensity are obtained by graphical representations that are as intuitive as the representation of the electric field. Third, the vector Stokes theorem and the divergence theorem become special cases of a general theorem that is easier for the student to remember, apply, and visualize than their vector formulation. Finally, computational simplifications result from the use of forms: derivatives are easier to compute, integration becomes more straightforward, and families of vector identities are easier to prove. In this paper, EM theory and the calculus of differential forms are developed from an elementary, conceptually oriented point of view using simple examples and intuitive motivations. It is shown that because of the power of the calculus of differential forms in conveying the fundamental concepts of EM theory, it provides an attractive and viable alternative to the use of vector analysis in teaching electromagnetic field theory.

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